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Electricity Generation from Organic Matters in Biocatalyst-Based Microbial Fuel Cells (MFCs)

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Abstract

Microbial fuel cells (MFCs) are a novel technology for converting organic matter directly to electricity via biocatalytic reactions by microorganisms. MFCs can also be used for wastewater treatment by the oxidations of organic pollutants during the electricity generation. Several factors for optimum power generation in MFC have been investigated at previous studies. A submersible microbial fuel cell (SMFC), which is a novel configuration, was developed by immersing an anode electrode and a cathode chamber in an anaerobic reactor. Domestic wastewater without any amendments was used as the medium and the inoculum in the experiments. The SMFC could successfully generate a stable voltage of 0.428±0.003V with a fixed 470Ω resistor from acetate. From the polarization test, the maximum power density of 204mWm−2 was obtained at current density of 595mAm^{-2} (external resistance = 180Ω). The power generation showed a saturation-type relationship as a function of wastewater strength, with a maximum power density (*P*max) of 218mWm−2 and a saturation constant (*K*s) of 244 mg L−1.We also achieved a successful power generation (123 mW/m^2) from wheat straw hydrolysate in a two chamber microbial fuel cells (MFCs). These results demonstrate that MFC has a great potential for a sustainable power generation and wastewater treatment with a better understanding and optimization of microbial electricity generation.